Dormont Parking Study

Quantifying and Characterizing Street Parking

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Project Information

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Section 1: Project Context

For decades the Borough of Dormont has suffered from congestion with street parking. Our project was tasked with creating a supply and demand model of parking availability within the borough. This overall objective was defined with several specific questions:

- How many parking spots are there in the borough?
- What types of parking are there, and who is using it?
- Is there a lack of parking and if so how do we alleviate this problem?

From the outset, it was clear that there was a perception of a lack of street parking. Visiting the site, our group could also tell that some areas were clearly congested, even though nearly every street in the Borough already had designated street parking.

Overall, we think that our analysis supports this perception; some areas of Dormont are clearly left with a dearth of parking. With the addition of other insights into the parking system of Dormont, including the application process and enforcement of parking restrictions, we have come up with several practical recommendations that, if implemented, will help alleviate the parking congestion problem in residential areas of Dormont.

Section 1.1: Location

Dormont is located in South Western Pennsylvania and is a borough in Allegheny County. Its relative location to Pittsburgh is indicated in Figure 1. Dormont is approximately 4 miles south west of downtown Pittsburgh. Some of the communities that surround Dormont are Mt. Lebanon, Brookline, Beechview and Banksville. A "T" line, which is the light rail system in Pittsburgh, runs through Dormont and connects it to the city. There are two T stations located in Dormont.

Figure 1: Dormont is Located Southwest of Pittsburgh

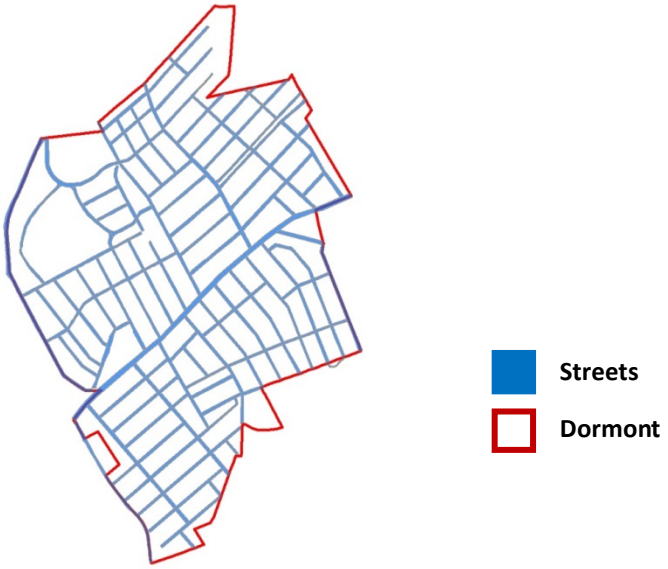
Section 1.2: Demographics

Dormont has a total land area of 484 acres (0.7 square miles). According to our estimates the number of houses in Dormont is around 4,310. The housing density in Dormont is 8.9 houses per acre which indicates that it is a very dense neighborhood. According to the U.S census the population estimate as of 2011 in Dormont was 8,612. According to the US Census the median age of the population is 36.4, which is below the US average.

Section 1.3: Zoning and Layout

Dormont has a grid type street network, as indicated by Figure 2. This means almost all the streets are perpendicular to each other. The grid-type network is symbolic of old American cities with its busy intersections and jumble of apartments, shops and restaurants. A study conducted by Davis, Garrick and Marshall found that cities that have a grid type network are safer in that they have fewer accidents and are easier to walk and bike. [1] The grid type nature of Dormont's streets also makes it easy to navigate. The streets are relatively easy to walk and there are ways of navigating specific streets to avoid uphill climbs.

Figure 2: Dormont has a Grid Type Street Network



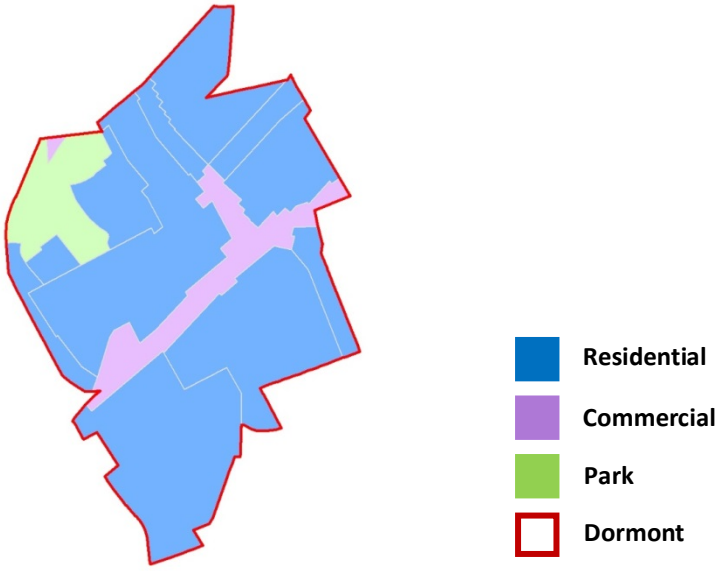
Section 1.4: Zoning

Dormont has a used-based zoning system which means that the commercial and residential zones are clearly demarcated. These zones are illustrated in Figure 3. The commercial zone is concentrated on two main roads – West Liberty and Potomac Avenue. Most businesses are located in these two areas. The rest of Dormont is primarily residential with a mix of detached homes as well as apartment buildings. A park is located on the north west of the borough and it is also the location of a swimming pool. The

[1] Marshall, W. E. and N. W. Garrick. 2010. Street network types and road safety: A study of 24 California cities. *Urban Design International*, 15(3), 133-147.

swimming pool is one of the largest pools in Pennsylvania and is a gathering point for seasonal activities for both adults and children, like the Fourth of July celebration.

Figure 3: Dormont has a Use-Based Zoning Code



Section 2: Stakeholder Analysis

Within Dormont there are multiple parties involved in the long term vitality of the region. Below is an analysis of important stakeholders in the Borough of Dormont, and what their goals and interests are when it comes to the parking problems of the area.

Borough of Dormont: This consists of the council members as well as the members of the traffic and parking commission. The traffic and parking commission works in an advisory capacity and makes recommendations regarding parking problems to the council members. Since the Borough of Dormont will make the final decision regarding parking related issues they will have the most influence in the parking study project. However, their decision can be influenced by the other stakeholders involved, such as business owners and Borough residents. Their key role will be to make a decision after reviewing the evidence provided with regard to parking issues in the borough and look at the view points of the various stakeholders involved.

Residents: Since residents constitute a large portion of the Borough, they will be the next most influential in terms of the type of decisions being made. As mentioned above, the Borough of Dormont will need to keep in mind the residents and their interests while making a decision. The residents of Dormont want better parking for themselves as they are quite dissatisfied with the current parking situation, as shown from our study. The residents can play a large role in influencing the decision made by the Borough. The residents are also the tax base for the Borough, hence keeping them satisfied will reign heavily with the members of the council.

Business Owners: After the residents, the next most influential will be the business owners. Some of them might also be residents of the Borough. Their key interest in the parking study is that they would like to have better parking for their customers as this would definitely determine the success of their business. Their customers could be either the residents of the borough or people from the neighboring areas. Since their needs are important and they do bring in visitors to the area, the final decision made by the council will be influenced by the businesses as well.

Visitors: As mentioned earlier, visitors from the surrounding neighborhoods will want to have convenient parking that are in close proximity to the businesses they are visiting, which could possibly determine their next visit to the Borough. The decision made by the Borough will definitely influence their future visits to the neighborhood.

Section 3: Project Methods

In order to conduct our study we used several methods of data collection and analysis. The methods are listed below.

Geographic Information System: We utilized ESRI's ArcMap GIS tools for much of the analysis. It was used to analyze existing conditions and collect the required data. Street and lot parking was plotted on maps and counted in order to identify deficits/surplus in parking. The maps were populated using data that was provided by the borough, US Census, as well as data collected from surveys.

Surveys: We felt that the best way to understand the parking habits of the residents as well as businesses was to conduct a survey. Three different surveys were created - for residents, businesses and for T commuters. A stratified random sample was designed and around 2,000 surveys were sent out to the residents of Dormont with the help of the Borough. Around 600 surveys were received back from the residents. This was a 35% response rate – much larger than we expected – giving us a fair idea about the parking and commuting habits of residents. Unfortunately, we did not receive equal response rates from every block. This limited our ability to correlate factors such as average number of cars per house and satisfaction at the block level. In addition, the surveys received from the businesses were not adequate and hence we could not draw too many conclusions with regard to businesses and their customer parking habits. Finally, although we did receive an adequate number of surveys from T commuters, time limitations precluded us from analyzing the data.

Case Studies: We researched several case studies of parking issues and technologies utilized by other cities. Cities like Calgary, Utrecht and Amsterdam were reviewed to see the strategies they used as well as technologies that they relied on in order to make parking effective. Smart meters were researched to see their effectiveness and the services offered.

Communication: The project team was in constant touch with Borough members, meeting consistently every month in order to understand their needs and also to get a better understanding of the parking habits and problems they face. The project team gained insight to the issues regarding parking and were able to get a deeper understanding of the situation because of this.

Section 4: Types of Parking

Parking in Dormont varies according to the zoning. Each major type of parking is described below, organized by type of zone.

Commercial: The commercial area is concentrated on West Liberty Avenue and Potomac Avenue. The parking here consists of street as well as lot parking. All public street spots and public lots are metered.

In Figure 4 below, metered street spots are represented in orange and public lots are represented in red.

Figure 4: The CBD has Metered Street Parking and Private and Public Parking Lots

Residential: Most of the parking in residential areas is street parking. On-street parking consists of:

1. regulated parking; and
2. unregulated parking.

Regulated Parking means that permits are required by the residents in order to park in those particular zones. However, these zones are not contiguous – e.g., one part of a block might fall under a regulated parking zone and another part might fall under unregulated parking zone.

Unregulated Parking does not require any permit and is basically a free-for-all parking system. A large portion of the residential area falls under the unregulated zone.

Figure 5 illustrates the parking in the residential zone. The green lines represent on street parking. As can be seen, some of the green lines fall under zone 3 or zone 4 which are two regulated areas, but the vast majority of the parking falls in unregulated zones.

Figure 5: Residential Areas Have Permit and Non-Permit, Non-Metered Street Parking

Section 5: Analysis

The main products of our analysis include three things:

1. estimates of the total number of spots, as well as categorization of the different kinds of spots;
2. survey statistics such as average number of cars per house, how many people per house, etc.; and
3. maps of this data, including where spot 'surpluses' and 'deficits' exist at the census block level.

Section 5.1: General Analysis Findings

Table 1 provides a summary of the main findings from our spot estimates and surveys:

Table 1: Main Study Findings

Statistic	Total Parking Spots
Spot Estimate Results	
Number of Spaces	4,759
Spots per House	1.1
Survey Results	
Cars per House	1.64
Satisfaction (1 – 4)	2.59
Number of Responses	598

Some immediate conclusions can be garnered from these numbers, including:

- in total, not including off-street parking such as driveways, parking pads and garages, for every **ten houses** there is a **shortage** of roughly **5 parking spots**; and
- Dormont households have a **satisfaction of 2.59**, indicating that on average **households** are **generally dissatisfied** with the current parking situation.

Total parking may be characterized in a variety of ways, including: street, parking lot, un-metered, metered, regulated, or unregulated. Our analysis was primarily concerned with parking that can be used by borough residents for long term, everyday parking needs; this includes parking such as residential permit spots, or parking that is completely unregulated. Appendix A contains break downs of the remaining types of parking identified by the group, including each type and the number of estimated spots available in the Borough.

Certain types of street parking represent the biggest opportunity for the borough to help alleviate the current parking problem. Focusing on these categories leads us to exclude a fraction of the total parking highlighted above. In general, this exclusion includes all of the parking lot spots – the vast majority of which is either metered or private apartment lots.

Table 2 breaks down the total from Table 1 in terms of street parking:

Table 2: Street Parking Overall Findings

Statistic	Street Parking
Number of Spaces	3,325
Spots Per House	0.77
Cars per House	.82

Our survey results indicated that half of the cars per house, 82 of 164 for every 100 houses, park on the street regularly. Using this finding, we find that the shortage of 5 spots per 10 houses highlighted before shrinks, now to a shortage of roughly **5 spots** for every **100 houses**.

This finding is misleading, however, because it includes regulated spots, either permitted or metered, as well as parking that is completely unregulated. Breaking down this parking even further in Table 3, the 'Un-metered Street Parking' categorization represents parking available to residents for long-term, everyday parking needs. As we have mentioned, this number represents the realistic 'maximum capacity' that is at the Borough's disposal for residential street parking demand.

Table 3: Street Parking Detailed Findings

Statistic	Un-metered Street Parking	Borough Controlled Free Street Parking
Number of Spaces	3,006	1,517
Spots Per House	0.7	0.35
Cars per House	.82	.82

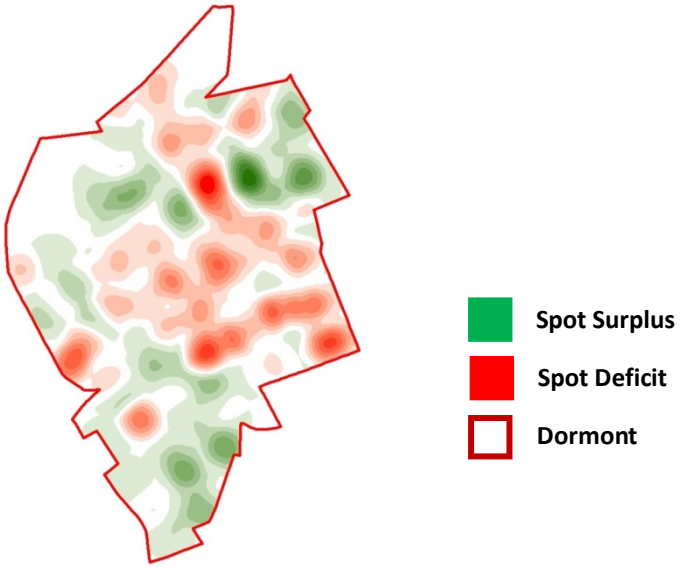
Interpreting the table, the shortage increases to **12 spots** for every **100 houses** when we consider only free parking. Of this capacity, considering what the borough can control, we find that the deficit is even greater, **47 spots** short for every **100 houses**.

. Interpreting this last finding, it tells us that of the total capacity that residents have at their disposal to meet their street parking needs, the borough controls only **35 spots** for every **100 houses** to meet the demand of **82 cars** that want to park on the street. This leaves a whopping **35 spots** per 100 houses left for residents to fight amongst themselves to use. This 'free-for-all' of 35 spots for every 100 houses is where we expect the roots of the parking problem to exist.

Section 5.2: Mapping Analysis Findings

The general findings of the analysis are quite powerful in and of themselves. Using GIS as one of the primary tools of the analysis, however, allowed us to increase their usefulness. Essentially, the group was able to replicate the process followed above and calculate street spot deficits across the Borough, at the census block level. The results of this deficit calculation for each of Dormont's blocks resulted in the map presented in Figure 6. Green areas represent blocks that, on average, have more street parking than is in demand, whereas red areas are blocks that have more cars parking on the street than there are designated un-metered street spots.

Figure 6: Non-Metered Street Parking Spot Deficit and Surplus Map



Of primary interest is the fact that, even though we calculated that every 100 houses on average is lacking 12 street spots, when done at the block level we find that some areas of Dormont are lacking spots, and some areas actually have a surplus of un-metered street spots. Because we are using borough wide averages, these surpluses and deficits are largely a function of housing density; in general, more dense areas will have fewer un-metered street spots per house, leading to a greater.

The remainder of this paper will focus on recommendations for alleviating this general parking deficit problem. Based on the particular recommendation, we may highlight additional more in-depth findings that can be viewed as evidence for the problem, and for the recommended solution.

Section 6: Recommendations

The group's recommendations attempt to alleviate two main problems:

1. an overall lack of street parking supply to meet estimated demand; and
2. a lack Borough control over available parking, needed in order to guarantee that every household in Dormont has an equal opportunity to park cars on the street.

The group came up with several specific recommendations in order to help solve these main problems, which includes:

- increase street parking capacity by updating one and two way street designations;
- expand residential permit parking areas;
- create 'flexible' parking areas;
- update the residential permit application process;
- increase the residential permit fee; and
- install a smart meter system in the commercial business district.

In addition to each of these recommendations, the group believes that the Borough should begin to promote a general culture of walking and transit usage. This last recommendation can be interpreted as a solution to the problem when it is framed from the perspective that Dormont simply has too many cars. The remainder of the paper will go through each of these recommendations in detail.

Section 6.1: Update One and Two-Way Street Designations

From our survey findings, we found that roughly 82 cars park on the street for every 100 houses. When simply considering the total number of street spots, without considering if they are permit, non-permit, or metered, this demand equates to a deficit of **5 spots** for every **100 houses**. To alleviate this problem, and to build in some flexibility into the system, we propose that at the borough level, the parking spot goal should be that, on average, every house would have the equivalent of **1 street parking spot**. Table 4 illustrates this goal, and the change in the number of spots required across the entire Borough that would be required to meet it.

Table 4: Street Parking Dormont Needs to Add

Parking State	Street Parking Spaces	Spaces per House	Cars per House	Spot Difference
Current	3,325	0.77	0.82	-.05
Goal	4,310	1.00	0.82	0.18
Change	985	0.33	--	--

As the table shows, across the entire Borough, a goal of one street spot per house based on our housing estimates would equate to 4,310 spots, a change of 985 street spots. Based on the estimated number of cars parking on the street per house, this would change the 5-spot deficit per 100 houses to an 18 -spot surplus per 100 houses, on average across the Borough.

It is important to note that these numbers remain at a Borough average. At the block level, the number of street spots actually allocated per house would more than likely vary. For instance, one house may apply for two street parking spots, while another would apply for none. This scenario still meets the requirement; on average, each house is using one street spot. Thus, based on block estimates of the number of available spots, Borough officials will be able to use their discretion when approving residential permit applications. This process will be explained in more detail in a later recommendation.

The proposed method to achieve this goal is simple: re-designate certain interior, residential streets that currently have traffic flowing in two-ways with parking on one side to one-way streets, giving added clearance to add parking to the other side of the street. Clearly, the streets that would be subject to this alteration must be chosen carefully; it will only work if the block with the deficit in parking is surrounded by streets on all sides, and if those streets do not constitute major traffic flows through Dormont. Appendix B contains a table that indicates street spot deficits at the block level. These deficits equate to the number of spots that need to be added to streets adjacent to each block, and when used in conjunction with the GIS maps can be used to select where parking can be added. We will use a simple example to illustrate this process.

Figure 7 illustrates a two block area that was estimated to have a street parking deficit. The blocks in question, and the parking that is allocated to them are highlighted with a red cross-thatch. As is shown in the figure, all of the streets bordering those blocks have traffic moving in both directions.

Figure 7: Example of Block Level Street Parking Deficit

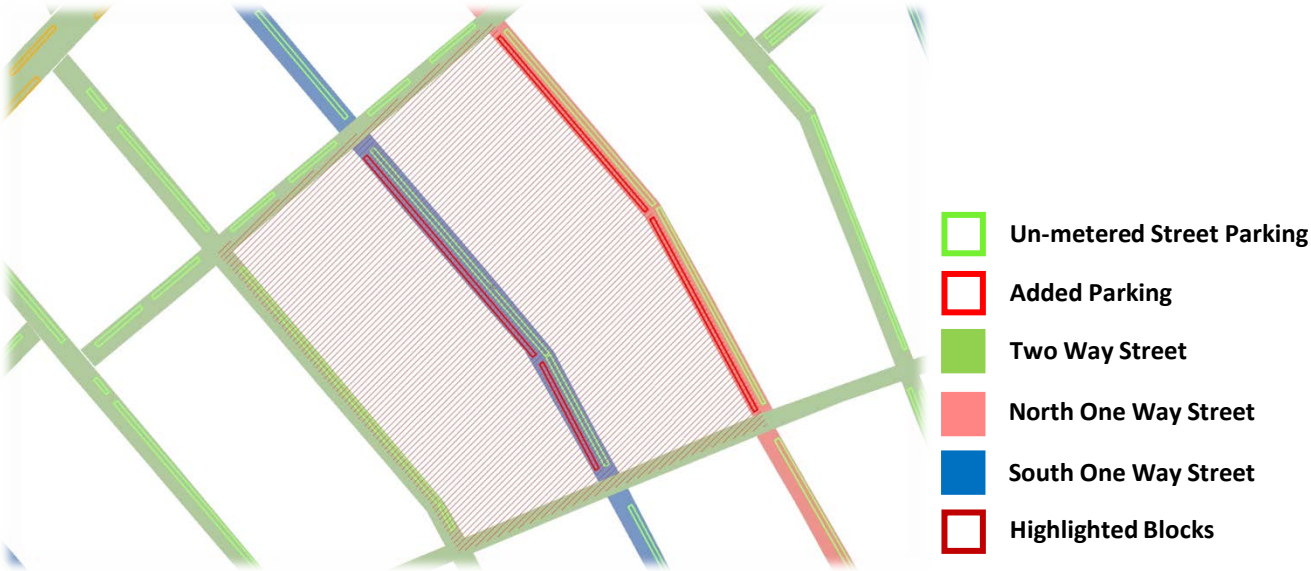
Given the current scenario, we are left with a **deficit of 34 street spots**, as indicated in Table 5.

Table 5: Example of Block Level Street Parking Deficit Calculation

Statistic	Value
Estimated Street Parked Cars	85
Estimated Free Street Spots	51
Estimated Free Street Spot Deficit	35

Implementing our solution, as indicated in Figure 8, two of the streets would be converted to one-way, running in opposite directions, and the added clearance could be used to add street parking on the other side of the road.

Figure 8: Example of Block Level Street Parking Addition



As indicated by Table 6, this would increase the capacity for parking by more than double, from an estimated 51 spots to 109. This addition would leave the two blocks with a surplus of street spots, roughly 24 according to the estimates.

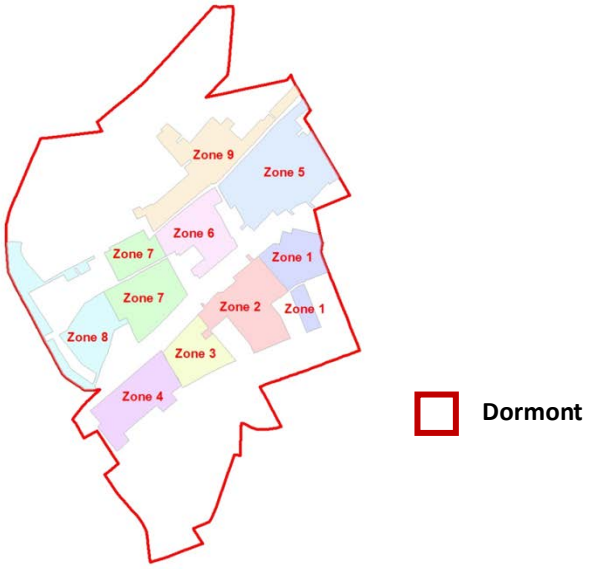
Table 6: Example of Block Level Street Parking Addition Calculation

Statistic	Value
Estimated Street Parked Cars	85
Estimated Free Street Spots	109
Estimated Free Street Spot Surplus	24

Section 6.2: Expand and Amend Residential Permit Area Requirements

Beyond adding additional spots, as we indicated in our analysis section, a big part of the problem is that half of the currently available non-metered street spots are not regulated by the Borough. This means that residents are not given an equal chance to park on the street, because these 35 spots per 100 houses are used on a 'first come first serve' basis. Not only does this create conflict among neighbors, but it also directly contributes to the congestion problem and also represents a lost revenue stream for the Borough. Figure 9 indicates the location and shape of current residential permit areas in the Borough.

Figure 9: Current Residential Permit Zones



Not only do the permit areas not cover the entire Borough, including some areas where street parking deficits are a serious problem, but even in the areas they are located, they are not close to contiguous. In order to meet the 1 street spot per house average, we recommend that these permit areas be expanded to include the entire borough. This includes the commercial business district; from our surveys, there are clearly residents that inhabit second floor apartments in this area, and who have indicated that they park cars on the street. This fact means that parking in some areas of the borough are dual use, commercial and residential, which supports the next recommendation: some areas of the Borough should have a 'flexible' system, in which permit holders are exempt from using the meter system. We discuss this recommendation in more detail later.

In addition to expanding the permit areas to the entire Borough, we recommend changing the enforcement time for the permits. As indicated by the figures in Appendix C, the greatest spot deficit estimated by our models occurs at night, a time when the current permit system is not being enforced. Therefore, we recommend that either the permit enforcement time be switched to cover this night and early morning period, or that it be enforced 24 hours a day.

Section 6.3: Create 'Flexible' Permit Areas in Central Business District

As is shown in Figure 6, a large portion of the area included in the Central Business District (CBD) has a deficit of un-metered street spots that could be used by residents living in these areas; this is due to the fact that all of the street parking within a block of the CBD is metered only.

As is discussed later in the paper, we were unable to conduct all of the analyses we hoped to, which included creating a more accurate supply and demand model for the CBD area. However, there is more than enough evidence to suggest that this area contains residents who park their cars on the street, and it is more than likely that visitors of the Borough park in and around the CBD in order to avoid having to use the metered parking; part of the problem, then, is that there is no parking available along the CBD for residents, and the other part is that there is a lack of enforcement on the part of the Borough in the residential permit areas. Additional recommendations to alleviate some of these problems include installing a smart meter system and increasing enforcement, which are discussed later in the paper.

As an immediate step, however, the borough should designate 'flexible' permit areas in and around the CBD. This recommendation builds on Section 6.2, expanding the permit areas to include the entire Borough; residents who live in the CBD should be given a chance to park on streets adjacent to them and not have to pay the meter, based on the fact that they would have to pay to have a residential permit. This would also give the Borough the ability to expand the metered area further into current residential permit zones, so that visitors who come to the CBD will not as easily be able to escape metered parking.

We recommend expanding the metered areas to roughly two blocks beyond the CBD, as this is a reasonable distance (about 1/10 of a mile) to assume that someone who is visiting the CBD would walk to use its amenities. This expansion would also indicate the extent of the new flexible permit area; residents who have permits for this special permit area would be exempt from having to pay at metered spots. Some additional research is needed in order to accurately estimate how many residential permits should be allocated within this area. This includes getting a more accurate estimate of how many cars are owned per households that are located in the CBD, and also estimating how many visitors the CBD receives on an average day and where they are parking.

Our group began some of this work, but we simply did not receive enough survey responses from households within CBD blocks, nor did we receive enough data from business on how many customers they had on an average day. Even so, with the residential surveys results we received from CBD blocks, there was clearly a distinct average number of cars owned per household compared to normal residential households. The breakdown of all of the survey data averages, at the borough level and also between residential and CBD households, is given in Appendix D.

Section 6.4: Update Residential Permit Application Process

All of the recommendations to date speak of expansion; they will help to alleviate the parking problem simply by increasing the capacity of street parking in the Borough. In addition to this, however, we have also recommended that all of the parking within the Borough be regulated. It is clear that, although part of the problem is a lack of parking (12 spots per 100 houses), the other part is that too much of the

parking that is available constitutes a free-for-all for residents; this likely incentivizes residents with many cars to keep them parked in those areas continuously, and perhaps to even alter their own schedules in order to make sure they can get parking when it is available.

In addition to expanding regulated areas, the Borough needs to ensure that it is allocating parking permits in those areas equitably. As we have mentioned before, this effectively means that the Borough will need to be constantly aware of what the capacity of parking is for a given block, and strictly limit the number of permits awarded. An updated permit application system will make this possible, enhancing the effectiveness of these new regulations by making the process through which residents can obtain permits more fair.

There are many things that could be considered as additional questions to add to the permit application process; we believe that the residential permit survey we designed is a good starting point from which to choose additional questions that should be asked of a resident when they request a permit. Examples of some of these considerations include: 1. 'Which block do you live on?' 2. 'How many street spots are available on that block?' 3. 'How many cars do you own?' 4. 'How many permits do you have currently?' 5. 'Do you have available off-street parking, and how much?' and perhaps most importantly 6. 'After we approve this permit, are we below the total number of estimated street spots available for this block?'

With this added information, the Borough can successfully alleviate some of the parking congestion that currently exists. We also recommend that residents be required to re-apply for permits more frequently, such as every 6 months, in order for the Borough to have a more constant flow of parking data. This means additional revenue even at the current $10 per permit, and that the Borough can adapt to the parking situation with more ease. The remaining recommendations would help facilitate the first four, in the form of additional revenue and more efficient enforcement of parking requirements.

Section 6.5: Increase Residential Permit Fee

With the added regulations, the group recommends that the Borough also increase the residential permit parking fee. The Borough may need to spend additional resources in order for the other recommendations to be feasible, especially when considering increased enforcement, something we cover later in the paper.

Currently, the Borough charges residents $10.00 a year in order to obtain or renew a residential permit. Based on our data, with 1,954 residential permits, annual revenue generated for the Borough amounts to roughly $19,500. Appendix E contains a revenue matrix that shows what would occur if the Borough increased this fee, and also if they took into consideration the prior recommendations of increasing the number of street spots and expanding the permit areas to cover the entire Borough.

The upper right cell of Table 20 represents the most ideal situation: if the Borough reached the 1 spot per house goal outlined in Section 6.1, and increased the permit fee per year to $40, they would receive $172,400 in revenue. This money is roughly 9 times the amount received now, and would help immensely to cover increased costs associated with smart meters, additional enforcement, and other

personnel needs. Additionally, if re-application were required once every 6 months versus once a year, the fee could be assessed in two $20 increments, something residents may be less resistant towards.

On the opposite end of the spectrum, the bottom left hand cell represents a situation that is closest to what Dormont currently has in place. So, even if the Borough were to not increase the number of spots, increasing the permit application fee would result in one of the revenue amounts located in the bottom row of the matrix. We would hope that, at the very least, the Borough would add spots to residential permit areas even if they would not increase the annual permit fee. Depending on how many spots were added, this would result in any of the revenue amounts located in the '@ $10' column of the matrix.

It is important to note the usage amounts column. Even if the Borough were to follow all of our recommendations and reach 4,310 street spots, if only 90% of those permit spots were filled, that would result in roughly 3,880 residential permits in circulation. The revenue stream would be equal to one of the amounts located in that row, depending on the fee assessed by the Borough.

Perhaps most importantly, an increased permit fee would bring a sense of uniformity to Dormont and its parking regulations. An increase in permit parking fees would ultimately benefit the Borough, in the form of increased revenues. It would also, however, persuade residents to realize that street parking in Dormont is a privilege, not a right. A $10.00 annual fee does not express any such privilege.

Section 6.6: Add Smart Meter System to the Central Business District

Currently, the Borough employs a single individual to monitor and enforce parking restrictions. Unfortunately, even considering Dormont's relatively small size (roughly .7 square miles), one person is simply not enough to cover the entire Borough. Therefore, this single employee typically monitors metered lots and metered street spots. This translates to very little enforcement in the residential permit areas. Residents are left to call the police to enforce any residential permit violators. Please note that these violators receive a $10.00 fine for the infraction. This minimal fine amount does nothing to discourage violators from becoming repeat offenders and further frustrating residents.

It will be necessary for the Borough to increase the efficiency of enforcement in order for the other recommendations we have made thus far to be even remotely effective. For instance, although we have recommended that the entire Borough be placed under permit zones, if no one is enforcing those restrictions then the parking problem currently experienced will likely not be fixed. The increased permit fee recommendation in Section 6.5 would provide the appropriate revenues that would be needed to implement this 'increased enforcement' recommendation. There are a few different ways that this revenue may be applied in order to achieve this goal.

Advances in technology have made it possible for smart meters to grant various payment options, collect key data, wirelessly connect via the cloud, and assist parking agents in efficiently regulating metered parking. As a part of our research, we looked into how much a smart meter system would cost for the Borough to install in the CBD. Table 7 below illustrates some of the per meter costs we found.

Table 7: Smart Meter Cost Findings

Meter Company	Price per Meter
Duncan[2]	$7,125
Cale1[2]	$7,150
SchlumbergerSema[3]	$6,100
Parkeon Inc[3]	$6,600
Parkeon and Cale[4]	$7,500

The second part of the smart meter analysis required the group to measure the number of smart meters we thought would be needed to cover all of the current areas where meters are located in the Borough. Thus, this estimate does not include areas that the borough may want to add more meters to, as was discussed in Section 6.3.

The first thing to note is that the smart meters we considered replace several regular parking meters. Thus, for an entire parking lot for instance, all of the meters that comprised that lot would be replaced by a single smart meter. In order to estimate the number of smart meters the Borough would need, we chose to count how many distinct areas, whether they were parking lots or street parking spaces, metered parking appeared in. Using this methodology we estimated that the Borough would need to install **78** separate smart meters in order to cover all of the current metered street and parking lot locations. Taking an average of the per meter costs we found from our case studies, this equated to a total installation cost of roughly **$537,810**.

There is no doubt that this is a substantial investment on the part of the Borough. We would have liked to give the Borough an estimated range on the payback period for such a project, but that is hard to accomplish without knowing meter revenues. Assuming that some of the residential permit revenue would be applied to this project, however, we were able to give a range on how long it would take to pay back this amount solely using those funds. This is represented by Table 21 located in Appendix E. At current revenue levels, an investment of this magnitude would take roughly 25 years to pay back, whereas at the ideal state, it would take only 3 years. Other combinations of permit usage and permit fee amounts fill in the yearly payback times for the remaining cells in the matrix.

Not only would smart meters make enforcement in the CBD area more efficient, it would also free up current personnel resources to be able to enforce the other areas of the Borough. So, if the current employee that monitors parking restrictions could do his job in half the time due to the smart meters, he would also be able to enforce restrictions in some residential areas. Once smart meter installation costs are recovered, the increased annual revenue may be applied to hiring more enforcement personnel so that it would be possible to enforce parking restrictions throughout the entire Borough.

[2] Kindred, Charles. 2012. CALE Pay & Display Multi-Space Meter Pilot.
[3] McCourt, Ransford S. Smart Parking Meters Take over the West. DKS Associates.
[4] City of Portland. 2011. Green Purchasing Case Studies: Solar-Powered SmartMeters Streamline Portland's Parking. Portland, OR: Portland Bureau of Transportation.

This idea represents only one possibility for increasing enforcement in the Borough. There may be additional options the Borough would like to consider in order to do this, but the bottom line is that with additional revenues, the feasibility of any options increases dramatically.

It should be noted that choosing the appropriate meter setup is integral to meeting the particular needs of Dormont's parking situation. In one study we reviewed, the choice between two metered systems was shown to have dramatically different outcomes based on the specifics of that city's situation. [5] Appendix F shows a side by side comparison of the smart meter systems considered in that study. While the Cale meter system performed best, the system that is ultimately best for Dormont may be something different. We recommend that further study into smart meter systems is conducted in order to find the optimal solution for Dormont and its residents.

Section 6.7: Promote Walking and Transit Usage

All of the recommendations we have made to date have framed the problem as having its roots in a lack of parking spots. There is another important way we could frame the problem, namely, that Dormont simply has too many cars. Through our research, we have found that Dormont is truly a walker's paradise: all of the streets are lined with sidewalks, almost all of the areas of the Borough are within walking distance of the CBD, and there are a multitude of transit options also within walking distance (.25 miles) of most residents. Selecting 8 addresses around different parts of the Borough and calculating their 'Walk Score' (www.walkscore.com), we also found that, on average, Dormont has a walk score of 78.

Based on all of this information, we recommend that the Borough promote walking and transit usage, in tandem with all of the other recommendations we have made. This recommendation is not as easily implemented as some of the others; indeed, what we are referring to is changing the culture of the area, from one that is car dependent to one that is pro-walking. This will likely take many years to fulfill, and that is why we recommend that the Borough start immediately.

There are many additional resources that can be referenced in order to get started on this walking and transit campaign; some websites to get started are located in Appendix G. Examples of programs the Borough may want to consider include:

- creation of senior walking programs, which would help elderly residents to find walking routes easily accessible to them;
- promoting 'walk to work' or 'bike to school' days, which is something already done in many larger cities such as San Francisco; and
- incentivizing residents to get out and participate in the community through 'block party' events.

Through talking with Borough officials and community members, we learned that the Dormont pool is a popular and widely used amenity in the community. Building incentives to walk rather than drive to the pool may be an effective way to beginning promotion of walking culture.

[5] Kindred, Charles. 2012. CALE Pay & Display Multi-Space Meter Pilot.

Section 7: Next Steps

The information contained in this parking study is meant to assist the Borough of Dormont in making the most informed decisions concerning how it addresses parking in the future. This section is our recommended next steps and the thought process that went into the recommendations. We are aware that some steps may take longer than others, but a clear plan with a goal in sight is the best way for a group to progress.

Section 7.1: Recommendation Priorities

1. Promote Walking and Transit: As we mentioned before, this recommendation should be done in tandem with all other. Its implementation is less defined, but it should be a continuous endeavor. It could involve many things, such as Borough residents of all ages and genders getting out and enjoying each other and the wonderful outdoor space available to them in Dormont.
2. Update Application Process: This is the first directly implementable next step, whose main purpose is to collect additional data. We will address the reasoning behind this more in the next section. In short, it is the foundation to facilitating all of our other recommendations.
3. Expand and Update Permit Areas: This recommendation could be done in tandem with the prior, and facilitates uniformity of parking regulations and enforcement in Dormont. This also provides the Borough with an additional source of the revenue.
4. Increase Enforcement: This step is made in part by the increased revenue and includes updating meters in the CBD, along with personnel, to properly regulate the new parking regulations.

Section 7.2: Immediate Next Step of Collecting More Data

In order for us to better explain to you the best next steps we looked back at our completed study and asked ourselves one question. If we continued working on the study, what would we do next? The answer was unanimous: collect more data!

We used a residential survey to collect our data and received a great response. This showed us that Borough residents are passionate about parking and interested about seeing it improve. We see this as a great opportunity to continue the trend and update the permit parking process to include a more thorough application. As recommended in section 6.4 this would allow for data on a block level to be easily collected on a rolling basis for the entire Borough of Dormont within a calendar year. So at a years' end of the process there would be data on file to make parking decisions at the block level. Being able to view parking accurately at the block level is what our study lacked in results, but we did gain the insight needed to make a clear plan on how to achieve the goal.

With the data available from each block, Dormont Borough Officials will be able to efficiently and properly regulate parking throughout. The idea of achieving a 1 to 1 ratio of car to house can then be seen as not just a reality, but instead a way of life.

Appendix A: Parking Types and Spot Estimates

Table 8: Types and Quantity of Street Parking

Type of Parking	Number of Spots
Total	3,325
Metered	319
Non-Metered	3,006
Permit	1,558
Non-Permit	1,767

Table 9: Types and Quantity of Lot Parking

Type of Parking	Number of Spots
Total	1,434
Public	279
Private	1,155
Metered	243
Non-Metered	1,119
Permit	184
Non-Permit	1,250

Table 10: Types and Quantity of Regulated Parking

Type of Parking	Number of Spots
Total	2,079
Street	1,863
Parking Lot	243

Table 11: Types and Quantity of Unregulated Parking

Type of Parking	Number of Spots
Total	2,680
Street	1,489
Parking Lot	1,191

Table 12: Types and Quantity of Regulated Street Parking

Type of Parking	Number of Spots
Total	1,836
Permit Non-Metered	1,517
Permit Metered	41

Non-Permit Non-Metered	278

Table 13: Types and Quantity of Regulated Lot Parking

Type of Parking	Number of Spots
Total	243
Public Permit Metered	184
Public Non-Permit Metered	59

Table 14: Types and Quantity of Unregulated Lot Parking

Type of Parking	Number of Spots
Total	1,191
Public Non-Permit Non-Metered	36
Private	1,155

Table 15: Types and Quantity of Private Lot Parking

Type of Parking	Number of Spots
Total	1,155
Business	323
Car Dealer	49
Church	150
General	16
Government	68
Housing	145
Recreation	190
School	52
Transit	162

Appendix B: Spot Deficit Estimates per Block

Table 16: Block Level Non-Metered Street Spot Deficit or Surplus

Block ID	Non-Metered Street Spot Budget
1R2420034721002002	-8.2
1R2420034721002003	-5.0
1R2420034721002000	-5.4
1R2420034721002005	-14.0
1R2420034721001007	-7.5
1R2420034721001004	3.2
1R2420034721002004	0.3

1R2420034721002001	-2.5
1R2420034721001003	14.4
1R2420034721001002	0.0
1R2420034721001001	-14.0
1R2420034721001006	-22.3
2R3420034721001005	-10.1
2R3420034721001000	10.4
2R3420034721001018	1.7
2R3420034721001011	0.0
2R3420034721001008	11.5
2R3420034721001010	-16.5
2R3420034721001012	0.0
3R3420034721002002	-1.6
3R3420034721002003	-13.7
3R3420034721002000	-7.9
3R3420034721002005	-3.1
3R3420034721001007	-2.8
3R3420034721001023	8.0
3R3420034721002004	-13.0
3R3420034721002008	5.9
3R3420034721002006	-4.0
3R3420034721002009	-2.5
3R3420034721002007	6.4
3R3420034721001021	-22.4
4R2420034722001004	-19.0
4R2420034722001006	-0.8
4R2420034721001022	-0.8
4R2420034722001011	-5.6
4R2420034722001005	-10.3
4R2420034722003015	-16.4
4R2420034722003012	21.0
4R2420034721002015	11.0
4R2420034721002014	-15.5
4R2420034722001002	-7.7
4R2420034722003013	-14.1
4R2420034722001015	-16.5
4R2420034721002013	-3.6
4R2420034721002011	-3.6
4R2420034721001019	10.5
4R2420034722001000	2.8
4R2420034722002000	-0.6
4R2420034722002002	-9.1
4R2420034721001023	-1.8
4R2420034722001012	10.8
4R2420034722003014	10.6
4R2420034721001020	14.0
4R2420034722001009	-6.0
4R2420034721002010	1.9

4R2420034721002017	6.2
4R2420034722003016	-11.0
4R2420034722003018	17.3
4R2420034722002004	8.3
4R2420034721002008	-1.9
4R2420034721002009	-12.4
4R2420034722002008	-1.7
4R2420034722002005	12.5
4R2420034721002016	8.7
4R2420034722002006	-8.4
4R2420034722003017	-6.7
4R2420034722002007	-17.6
4R2420034722002003	-14.8
4R2420034722001014	-1.1
4R2420034721002018	4.9
4R2420034721002012	1.8
4R2420034721001021	2.5
4R2420034722001001	-13.3
4R2420034722001013	-14.3
4R2420034722001010	-1.6
5R2420034721001024	19.2
5R2420034721001017	42.4
5R2420034721001015	4.3
5R2420034721001013	16.7
5R2420034721001026	28.0
5R2420034721001025	11.9
5R2420034721001028	-2.8
5R2420034721001016	6.5
5R2420034721001027	3.6
5R2420034721001014	-0.8
5R2420034721001012	0.0
6R1420034722001007	-0.8
6R1420034722001006	-3.5
6R1420034722003000	0.0
6R1420034722001008	-8.2
6R1420034722003005	1.0
6R1420034721002019	-3.1
6R1420034722003009	13.6
6R1420034722003004	0.0
6R1420034722003001	-1.6
6R1420034722003007	14.9
6R1420034721002016	-11.5
6R1420034722003008	-8.2
6R1420034722003010	-0.2
6R1420034721002018	-0.3
6R1420034722003006	23.7
6R1420034722003011	0.0

7C420034722001004	-5.8
7C420034722002011	0.0
7C420034723001010	0.0
7C420034722001002	-4.0
7C420034723001004	-7.6
7C420034722001015	0.0
7C420034721001019	-28.2
7C420034722001000	-12.6
7C420034721001024	-4.3
7C420034722002000	2.0
7C420034723001012	-5.3
7C420034722001003	-26.8
7C420034723001011	-12.4
7C420034721001017	1.0
7C420034722001012	-7.0
7C420034721001020	-12.9
7C420034723001009	-5.8
7C420034721001008	-0.6
7C420034722002001	0.0
7C420034721001025	-12.6
7C420034721001028	-17.5
7C420034721001009	-2.9
7C420034722002010	0.0
7C420034724001009	-23.3
7C420034721001027	0.0
7C420034724001000	-14.0
7C420034722001001	-11.7
7C420034721001014	0.0
7C420034723001000	0.0
7C420034722001013	0.0
7C420034724001008	0.0
7C420034723001003	-7.6
8R3420034723001001	6.8
8R3420034723002000	-14.3
8R3420034723003000	-7.0
8R3420034723003001	-16.5
8R3420034723001002	4.5
8R3420034723001003	-27.5
9R1420034722003004	4.0
10R3420034722003002	-14.2
10R3420034722003018	-0.8
10R3420034722002009	-34.9
11R2420034723002011	-1.6
11R2420034723001010	-5.6
11R2420034723002007	-24.7
11R2420034724001002	-44.5
11R2420034723003010	2.4
11R2420034723002003	-5.4

11R2420034723003003	-34.6
11R2420034723003008	4.5
11R2420034723001008	-7.5
11R2420034723001005	8.9
11R2420034723002008	13.2
11R2420034723002006	0.3
11R2420034723001012	-17.0
11R2420034723001011	1.8
11R2420034723001006	-20.9
11R2420034723001009	6.3
11R2420034723002009	-22.3
11R2420034723002005	-26.4
11R2420034723003009	-7.6
11R2420034723002001	3.9
11R2420034723003011	0.0
11R2420034723003002	1.5
11R2420034723003005	-8.1
11R2420034723003004	4.8
11R2420034723002010	-17.3
11R2420034723002002	-27.5
11R2420034724001000	10.6
11R2420034724001001	10.0
11R2420034723001007	12.5
11R2420034723003006	13.3
11R2420034723002004	2.9
11R2420034723003007	-14.8
12R1420034724002007	-1.0
12R1420034724001004	9.6
12R1420034724001007	4.2
12R1420034724002003	16.0
12R1420034724002010	6.4
12R1420034724001003	10.8
12R1420034724002002	23.9
12R1420034724001010	-0.7
12R1420034724001006	-4.4
12R1420034724002001	7.1
12R1420034724001013	6.4
12R1420034724001011	-30.6
12R1420034724002005	3.1
12R1420034724001015	1.9
12R1420034724002012	20.1
12R1420034724001012	-2.0
12R1420034724002008	-6.3
12R1420034724002009	6.5
12R1420034724001009	20.3
12R1420034724002006	3.6
12R1420034724002004	16.9

12R1420034724001014	-8.2
12R1420034724002011	-4.3
12R1420034724002000	4.9
12R1420034724001008	11.6
12R1420034724001005	5.4
13C420034722003001	0.0
14P1420034722003002	0.0
14P1420034722003000	0.0
14P1420034722003004	0.0
14P1420034722003001	0.0

Appendix C: Non-Metered Street Parking Availability by Time of Day

Figure 10: Morning Non-Metered Parking Availability

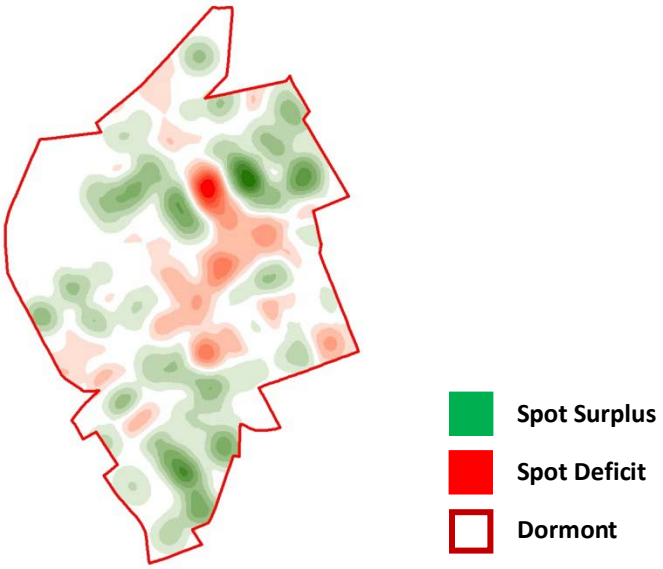


Figure 11: Mid-Day Non-Metered Parking Availability

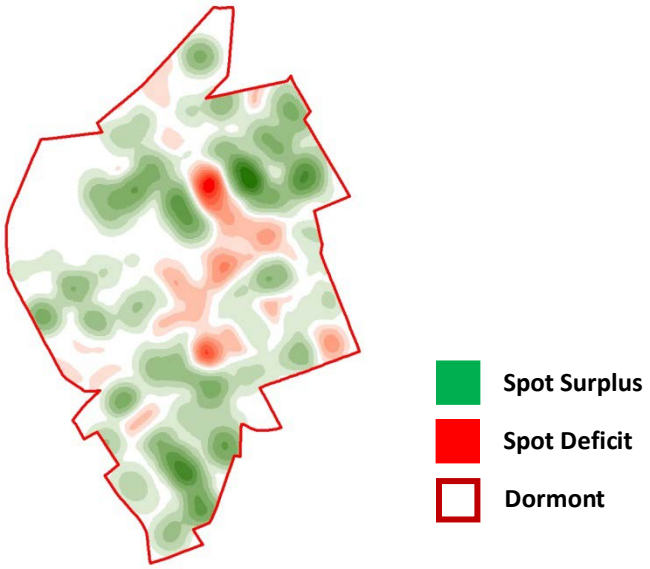
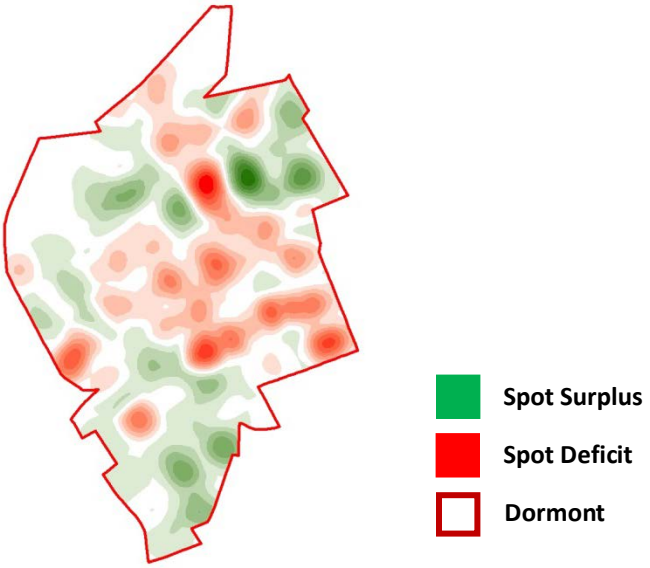


Figure 12: Night Time Non-Metered Parking Availability



Appendix D: Survey Result Summary Statistics

Table 17: Overall Borough Survey Results Summary Statistics

Statistic	Average	Standard Deviation	90% C.I. L.B.	90% C.I. U.B.
Number of People	2.26	1.15	0.37	4.15
Bus Commuters	0.10	0.34	-0.45	0.65
T Commuters	0.31	0.67	-0.78	1.40

Car Commuters	1.48	0.96	-0.09	3.05
Walking Commuters	0.39	0.89	-1.07	1.85
Number of Cars	1.64	0.85	0.24	3.03
Parked in Garage	0.39	0.60	-0.60	1.38
Parked on Pad	0.26	0.57	-0.67	1.19
Parked on Driveway	0.24	0.54	-0.65	1.13
Parked in Street	0.82	0.84	-0.55	2.19
Parked in Street: Morning	0.54	0.66	-0.55	1.62
Parked in Street: Mid-Day	0.50	0.62	-0.52	1.52
Parked in Street: Night	0.82	0.83	-0.54	2.17
Number of Permits	0.57	0.78	-0.72	1.85
Satisfaction	2.59	1.08	0.82	4.37

Table 18: Residential Block Survey Results Summary Statistics

Statistic	Average	Standard Deviation	90% C.I. L.B.	90% C.I. U.B.
Number of People	2.27	1.15	0.38	4.15
Bus Commuters	0.09	0.33	-0.45	0.63
T Commuters	0.31	0.67	-0.79	1.40
Car Commuters	1.49	0.96	-0.08	3.07
Walking Commuters	0.39	0.90	-1.08	1.86
Number of Cars	1.64	0.85	0.25	3.03
Parked in Garage	0.39	0.61	-0.60	1.39
Parked on Pad	0.25	0.56	-0.66	1.17
Parked on Driveway	0.25	0.55	-0.65	1.14
Parked in Street	0.82	0.84	-0.55	2.20
Parked in Street: Morning	0.54	0.66	-0.55	1.62
Parked in Street: Mid-Day	0.50	0.62	-0.52	1.52
Parked in Street: Night	0.82	0.83	-0.53	2.18
Number of Permits	0.56	0.78	-0.72	1.85
Satisfaction	2.60	1.08	0.83	4.37

Table 19: Commercial Block Survey Results Summary Statistics

Statistic	Average	Standard Deviation	90% C.I. L.B.	90% C.I. U.B.
Number of People	1.92	1.22	-0.08	3.91
Bus Commuters	0.42	0.61	-0.59	1.42
T Commuters	0.58	0.59	-0.38	1.55
Car Commuters	0.92	0.89	-0.55	2.38
Walking Commuters	0.42	0.52	-0.43	1.26
Number of Cars	1.25	1.05	-0.47	2.97

Parked in Garage	0.17	0.45	-0.58	0.91
Parked on Pad	0.42	1.01	-1.24	2.07
Parked on Driveway	0.00	0.25	-0.41	0.41
Parked in Street	0.58	0.83	-0.78	1.95
Parked in Street: Morning	0.50	0.68	-0.61	1.61
Parked in Street: Mid-Day	0.33	0.52	-0.52	1.19
Parked in Street: Night	0.58	0.83	-0.78	1.94
Number of Permits	0.67	0.79	-0.62	1.96
Satisfaction	2.42	1.18	0.48	4.35

Appendix E: Permit Revenue and Smart Meter Cost Matrices

Table 20: Permit Revenue Matrix

Usage Rate	Street Spots	@ $10	@ $20	@ $30	@ $40
100%	4,310	$43,100	$86,200	$129,300	**$172,400**
90%	3,879	$38,790	$77,580	$116,370	$155,160
80%	3,448	$ 34,480	$ 68,960	$ 103,440	$ 137,920
70%	3,017	$ 30,170	$ 60,340	$ 90,510	$ 120,680
60%	2,586	$ 25,860	$ 51,720	$ 77,580	$ 103,440
50%	2,155	**$ 21,550**	$ 43,100	$ 64,650	$ 86,200

Table 21: Years Needed to Cover Total Smart Meter Installation Cost with Permit Revenue

Usage Rate	Street Spots	@ $10	@ $20	@30	@40
100%	4,310	12.48	6.24	4.16	**3.12**
90%	3,879	13.86	6.93	4.62	3.47
80%	3,448	15.60	7.80	5.20	3.90
70%	3,017	17.83	8.91	5.94	4.46
60%	2,586	20.80	10.40	6.93	5.20
50%	2,155	**24.96**	12.48	8.32	6.24

Appendix F: Smart Meter Case Study Comparison

Table 22: Duncan versus Cale, Pasadena Metered Parking Study

Parking Citations	**Duncan**	**Cale**	**Difference %**
Number issued	864	1176	36.11%
Revenue generated	$39,744	$54,096	36.11%
Enforcement	**Duncan**	**Cale**	**Difference %**
Time for one block face	14 minutes	7 minutes	50%
Cale Parking	**# Requested**	**# Upheld**	**#Dismissed**
Citation Appeals	10	10	0
Duncan Parking	**# Requested**	**# Upheld**	**#Dismissed**
Citation Appeals	385	201	184* (48%)

*This represents a loss of $8,556; not including staff time and supplies.

Appendix G: Additional Resources

Walking Promotion

http://walksteps.org/case-studies/

Is a great site to find informative case studies and real world solutions to real world problems community's face. There answers that addresses issues pertaining to all genders and walks of life.

http://www.walkinginfo.org

Is the pedestrian and bicycle information center. This is a site that can assist with current laws, promotions, case studies, state resources, and trainings.

http://www.walkscore.com/

Is a wonderful resource that enable you to find out the walk score for a given point, community, and even city. We even found case studies in which city planners and other officials are using the walk score data to assist in how they maintain and expand the cities and communities they serve.

Smart Meter Case Studies

Kindred, Charles. 2012. CALE Pay & Display Multi-Space Meter Pilot. http://ww2.cityofpasadena.net/trans/parking/OPPMZAC/2012/041912/Item_VIIA_041912_OPPMZAC.pdf

McCourt, Ransford S. Smart Parking Meters Take over the West. DKS Associates. http://www.dksassociates.com/wp-content/files_mf/1335560385Smart_Parking_Meters_Take_Over_the_West.pdf

City of Portland. 2011. Green Purchasing Case Studies: Solar-Powered SmartMeters Streamline Portland's Parking. Portland, OR: Portland Bureau of Transportation. http://www.portlandoregon.gov/bibs/article/157993